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Cancer of the Stomach

A Patient Care Study by the American College of Surgeons

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Objective.
The major purpose of this study was to document the modes of presentation, diagnostic methods, clinical management, and outcome of gastric cancer as reported by tumor registries of US hospitals and cancer programs approved by the American College of Surgeons.

Summary Background Data.
Gastric cancer continues to diminish in the US, but the stage of disease and survival outcome after surgical resection is unchanged despite increased availability and sophistication of diagnostic techniques. This is in contrast to the marked improvement in survival outcome in Japanese and other Eastern series over the last decades. Possible reasons for the improved Japanese results have been earlier detection secondary to active diagnostic surveillance of the population and widespread adoption of aggressive surgical resection emphasizing wide-field node (R2) dissection. Although selected US centers using the Japanese approach report better survival data, the approach has not been widely adapted by US treatment centers.

Methods.
Tumor registries at American College of Surgeons (ACS) approved hospitals were mailed a study protocol in 1987. They were instructed to review 25 consecutive patients with gastric cancer treated in 1982 (long-term study) and 25 patients treated in 1987 (short-term study). A detailed protocol included significant history, diagnostic results, staging, pathology findings, and treatment results. The data forms on 18,365 patients were returned and analyzed (11,264 patients in the long-term study and 7101 patients in the short-term study).

Results.
Of 18,365 patients, 63% were males. The median ages were 68.4 years in males and 71.9 years in females. There was a history of gastric ulcer in 25.5% of the patients. Lesion location was upper third in 31%, middle third in 14%, distal third in 26%, and entire stomach in 10% of patients (and the site was unknown in 19%). Gastric resection was performed for 80% of upper third cancers and 85% of distal third cancers; 50% of patients with total gastric involvement had gastric resection. The extent of gastric resection varied according to location. For lower third lesions,

subtotal gastrectomy was done in 55% of the cases, extended resection in 21%, and total gastrectomy in 6%. For proximal lesions, 29% had subtotal, 4.6% had total, and 41% had extended gastrectomies (including esophagus), and 13.6% had dissection of celiac nodes. The operative mortality rate was 7.2%. Staging (American Joint Committee on Cancer [AJCC]) was as follows: I, 17%; II, 17%; III, 36%; and IV, 31%. The overall survival rate reflecting deaths from all causes was 14% among 10,891 patients diagnosed in 1982, and it was 19% in patients having resection. The disease specific survival rate was 26%. The survival rate after resection was 19% and 21% for lower and mid third cancers, 10% for upper third cancers, and 4% if the entire stomach was involved. The stage-related survival rates were 50% (stage I), 29% (stage II), 13% (stage III), and 3% (stage IV). Among patients with pathologically clear margins, the survival rate was 35% *versus* 13% in those with microscopically involved margins, and it was 3% in those with grossly involved margins.

Conclusion.

This report of gastric cancer treatment by American College of Surgeons approved institutions in the US provides an overview of the disease as commonly treated throughout the US. Although the results are less favorable than those reported by centers with large institutional experiences with this disease and are inferior to those of the Japanese and other Eastern centers, they suggest potential for increasing survival by upstaging through earlier diagnosis and using resectional techniques demonstrated to more adequately control local regional disease.

A patient care evaluation study of cancer of the stomach was initiated by the Commission on Cancer of the American College of Surgeons (ACS) in 1986 using data collected by the tumor registries of the ACS approved cancer programs throughout the US. Data on patients diagnosed in 1982 comprised the long-term study, and data recorded for patients diagnosed in 1987 formed the short-term study. The major purpose was to document the modes of presentation, diagnostic methods, clinical management, and outcome of gastric cancer therapy in the hospitals surveyed, as well as any change occurring during the 1982 and 1987 time periods. The study provided an opportunity to assess the validity and use of the staging system defined by the American Joint Committee on Cancer (AJCC) Staging[1,2] as a prognostic indicator, to determine the current relationship of precancerous benign conditions with gastric cancer,[3-5] and to review the use and yield of diagnostic efforts, such as gastroscopy, during these two time periods. A major aim was to review the pattern of care of these patients and to determine treatment outcome as reflected by survival and recurrence rates.

METHODS AND MATERIALS

The study protocol and the accompanying instructions were mailed to the tumor registries in the fall of 1987. Two study periods were involved. In the short-term study (1987), the tumor registrar was asked to review 25 patients treated at the hospital from January 1987 through December 1987. For the 1982 study, 25 patients were enrolled in reverse chronological order beginning in December 31, 1982. Primary gastric cancer consisted of all the sites listed in the International Classification of Disease in Oncology code from 151.0 to 151.9, including esophagogastric junction tumors. Malignant histologies included adenocarcinomas of various types such as general adenocarcinoma, mucinous, papillary, signet ring, tubular adenosquamous, diffuse type and intestinal type, and undifferentiated carcinoma. Excluded were leiomyosarcoma, leiomyoblastoma, lymphoma, and squamous cancer of the stomach. Detailed data-forms were tabulated and returned to the Commission on Cancer office with a receipt deadline of September 1, 1988.

The questionnaire requested information on age, sex, race, previous benign gastric condition, previous gastric surgery, initial diagnostic studies, initial diagnosis, and the anatomic site of initial histologic diagnosis. Also recorded were the anatomic location and size of the tumor and histology and histologic characteristics such as type, grade, and Lauren's classification.[6] The tumor was staged according to the 1988 AJCC. Specific details about the initial and subsequent therapy by surgery, radiation, and chemotherapy were requested. The various surgical procedures and types of gastric resection commonly used were listed. Removal of tissue beyond the stomach was labeled as extended gastrectomy. The use of adjuvant therapy after surgery and the overall patterns of recurrence and its treatment were recorded. When results are expressed as percentages, the figure is based on

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Table 1. AGE DISTRIBUTION BY SEX FOR PATIENTS WITH STOMACH CANCER DIAGNOSED IN 1982 AND 1987 (WITH REFERENCE TO THE US CENSUS POPULATION

	% Males			% Females		
Age (yr)	1982	1987	US Population*	1982	1987	US Population*
≤19	0.3	0.1	31.3	0.2	0.5	28.5
20–29	0.4	0.2	18.5	0.5	0.9	17.6
30–39	1.6	2.3	15.7	2.3	2.4	15.1
40–49	5.9	6.4	10.8	5.1	4.2	10.6
50–59	16.3	13.0	9.3	12.4	9.8	9.7
60–69	28.9	29.0	7.6	23.0	22.8	8.7
≥70	46.6	49.0	6.7	56.5	59.5	9.9
All patients	100%	100%	100%	100%	100%	100%
Total no. of patients						
Median age	68.0	68.8	—	71.4	72.4	—

* 1984 population data, US Census.

the number of patients in whom data were recorded and excludes patients in whom data were lacking. The extent of resection beyond the stomach was noted and categorized as *resected* (malignant or nonmalignant) or *nonresected* (malignant, or nonmalignant or unknown). In addition, the resection of extra gastric organs such as the colon, esophagus, gallbladder, omentum, pancreas, and spleen and the extent of lymph node dissection were noted. Information was requested regarding node dissections of the following sites: perigastric, gastric, common hepatic, celiac, splenic, or other.

All data were processed using an in-house computer and analyzed using standard statistical methods. Survival curves reflecting observed deaths from all causes at each year were generated using the actuarial life-table method, and differences among curves were analyzed using the Lee-Desu test statistic. All reported p-values are two-sided and unadjusted for multiple comparisons.

RESULTS

The data on 18,365 patients with carcinoma of the stomach were evaluated and collected from more than 700 ACS approved cancer programs throughout the US. The short-term study (1987) included 7101 patients and the long-term study (1982) included 11,264 patients. Sixty-three per cent were males and 37% were females. There were no differences between the 1982 and 1987 patients in age and sex distribution (Table 1). Of the total series, 51.3% were older than 70 years. Among the females, 58% were older than 70 years *versus* 47.8% of the male patients, suggesting that the disease occurs at an earlier age in males than in females. The median age was 68.4 years for males and 71.9 years for females. In contrast, the median age of the population in the US during the same period was 30 years for males and 32 years for females.

Symptoms

Major symptoms included weight loss and abdominal pain in more than half of the patients (Table 2). Nausea, anorexia, or dysphagia was recorded in approximately one third and melena in 20%. History included gastric ulcer in 25.5%, duodenal ulcer in 7.5%, pernicious anemia in 5.9%, gastric polyps in 3.5%, polyps in the large bowel in 3.0%, achlorhydria in 1.8%, and polyposis in the small bowel in 1.4%.

Table 2. SYMPTOMS PRESENT AT INITIAL DIAGNOSIS (1982 AND 1987 STUDIES COMBINED)

Symptom	
Total no. of new patients	18,365
Weight loss	61.6%
Abdominal pain	51.6%
Nausea	34.3%
Anorexia	32.0%
Dysphagia	26.1%
Melena	20.2%
Early satiety	17.5%
Ulcer-type pain	17.1%
Swelling—lower extremities	5.9%
Previous history	18,365 patients
Gastric ulcer	25.5%
Duodenal ulcer	7.5%
Pernicious anemia	5.9%
Gastric polyps	3.5%
Polyps in large bowel	3.0%
Achlorhydria	1.8%
Polyposis—small bowel	1.4%

Table 3. DIAGNOSTIC AND LABORATORY TESTS

	Tests Performed		Tests Suggestive of Cancer	
	1982	1987	1982	1987
Patients	11,641	7,311	—	—
UGI	82%	66%	75%	74%
Abdominal CT	28%	64%	65%	67%
Gastroscopy	88%	93%	87.2%	87.0%
with biopsy	—	—	90.9%	93.6%
with cytology	—	—	74.4%	74.2%
Other tests				
Abdominal sonogram	20.2%	19.3%	41.9%	40.6%
Liver scan	50.8%	17.3%	26.0%	32.6%
Chest CT scan	12.4%	22.9%	26.1%	39.5%
Bone scan	18.4%	12.7%	18.9%	22.3%
MRI	3.6%	3.4%	35.4%	48.1%

Table 4. ABDOMINAL SURGERY OPERATIVE RATE BY ANATOMIC INVOLVEMENT (1982 AND 1987 STUDIES COMBINED)

Anatomic Location	% of Patients Treated Surgically (No.)	% of Gastric Resections*
Upper third	74.1 (3,915)	79.9
Middle third	74.8 (1,794)	82.8
Lower third	85.8 (3,923)	85.0
Entire stomach	77.7 (1,362)	50.3
Other/unknown	69.9 (2,301)	70.4
All locations	76.9 (13,295)	77.1

* Any surgery excluding bypass only, exploratory only, local excision only.
Total patient base = 18,365 patients.

Diagnostic Methods

An upper gastrointestinal (GI) series was obtained in 82% of the 1982 patients, but only 66% of the 1987 patients (Table 3). The incidence of positive diagnosis for cancer was the same (75% and 74%, respectively, of those patients undergoing the GI series) in each of the time periods. The use of computed tomography (CT) scan increased from only 28% of the patients evaluated in 1982 to 64% of those evaluated in 1987, with two thirds of the tests suggesting cancer. Liver-spleen scan utilization decreased from 51% in 1982 cases to 17% in the group studied in 1987; about one third of these were suggestive of cancer. Among other laboratory studies, the alkaline phosphatase test was performed in 81% of the patients and had abnormal results in 35%. Carcinoembryonic (CEA) levels were determined in one third of the patients and were positive in 43% of those studied. An alpha-fetoprotein (AFP) value was obtained in 2.9% of the patients and was positive in 24% of those tested. Endoscopy was performed in 88% of the patients evaluated in 1982 and 93% of those patients studied in 1987. Endoscopic visualization suggested cancer to the observers in 87% of the cases examined both in 1982 and 1987 (Table 3). Biopsy specimens positive for cancer were obtained in 91% of the group examined in 1988 and 94% of those examined in 1987. The cytologic examination was positive for cancer in 74% during both time periods.

Lesion Location

The upper third of the stomach was involved by cancer in 30.5% of the overall group. The middle third and lower third of the stomach were involved in 13.9% and 26% of the patients, respectively. The entire stomach was cancerous in 10% and the site was unknown in 19%.

Treatment

Management was primarily surgical in 77% and was complemented by either chemotherapy and/or radiation in 34.7% of the cases. Of the total group of 18,365 patients evaluated, 13,295 patients (72.4%) were explored; of these, 77% had some form of gastric resection (Table 4). The frequency with which surgery was performed varied according to the location of the cancer in the stomach. Surgical exploration with or without biopsy, bypass, or resection was done in 74% of the patients with upper third and middle third lesions; in patients with lower third cancers this number was 86%, and in those with total stomach involvement it was 78%. Gastric resections for upper, middle, and lower third lesions were performed in 79.9%, 82.8%, and 85.0% of the cases treated surgically, respectively. Only 50.3% of the patients with entire stomach involvement who were treated surgically underwent resection. The type of surgery varied according to the location and extent of disease (Table 5). For distal gastric cancers, subtotal or partial gastrectomy was done in 55%, near total or total gastrectomies were done in 6%, and extended gastrectomy (gastrectomy plus resection of other organs) was done in 21%; gastrectomy not otherwise stated was done in 1.8%. In patients with lesions involving the upper third of the stomach, 29.1% had subtotal or partial gastrectomy, while 4.6% had near total or total gastrectomies and 40.7% had extended gastrectomies. The operative mortality rate (30-day) was 7.2%.

The percentage of patients with extra gastric organ resection is shown in Table 6. The esophagus was included in the gastrectomy in 25% of the patients. Gastric and perigastric nodes were included with dissection in 47%

Table 5. DISTRIBUTION OF TYPES OF SURGERY BY ANATOMIC INVOLVEMENT (1982 AND 1987 STUDIES COMBINED)

Type of Surgery	% of Anatomic Location			
	Upper Third (35.6%)	Middle Third (16.3%)	Lower Third (35.7%)	Entire Stomach (12.4%)
No. of patients*	3,915	1,794	3,923	1,362
Extended gastrectomy	40.7	26.9	21.1	25.3
Subtotal/partial gastrectomy	29.1	38.1	54.7	8.1
Total/near total gastrectomy	4.6	14.1	6.0	11.3
Gastrectomy NOS	1.9	2.4	1.8	1.9
Surg. of reg./distant nodes only	1.7	0.7	0.7	2.1
Surgery, NOS	1.9	0.6	0.7	1.6
Exploratory only	16.9	12.3	8.6	44.0
Bypass only	1.8	2.6	5.6	4.9
Local excision only	1.4	2.3	0.8	0.8
	100%	100%	100%	100%

*Total = 10,999 patients
Excludes 2,301 patients in whom location is unknown/other.

and 49%, respectively, and about 67% were cancerous. A smaller number of patients had dissection of extra gastric nodes. This included dissection of celiac nodes (13.6%), common hepatic nodes (6.2%), and splenic nodes (7.8%). Metastases to extra gastric nodes occurred in 57% for celiac lymph nodes and approximately 37% for common hepatic lymph nodes and splenic lymph nodes (Table 7).

Pathology and Staging

The pathologic stages were designated according to the International System (Table 8). Sufficient data were available to define the pathologic stage size in 11,087 of the 18,365 patients (60.4%).

Table 6. EXTRA GASTRIC RESECTION ORGANS RESECTED DURING GASTRECTOMY

Organs	No of Total Resections (%)	No. Involved by Cancer (%)
Colon	747 (7%)	350 (45%)
Omentum	4,270 (41%)	1,799 (41%)
Spleen	2,378 (23%)	241 (10%)
Pancreas	756 (7%)	301 (38%)
Esophagus*	3,000 (29%)	2,314 (75%)

* Generally resected in conjunction with proximal gastrectomy.

Table 7. LYMPH NODE GROUPS RESECTED DURING GASTRECTOMY

Lymph Node Group	No. Resected* (%)	No. Involved by Cancer (%)
Gastric	4,813 (47)	3,193 (66.3)
Perigastric	5,009 (48.9)	3,460 (69.1)
Common hepatic nodes	634 (6.2)	235 (37.1)
Celiac nodes	1,393 (13.6)	793 (56.9)
Splenic nodes	802 (7.8)	301 (37.5)

* Ten thousand two hundred thirty-seven gastrectomies. Among patients having gastrectomy with clear margins, 4.7% had an R2 dissection of the second echelon of nodes (celiac axis, common hepatic, and/or splenic nodes).

There were no differences in stage distribution between patients evaluated in 1982 *versus* those evaluated in 1987. About 34% were equally divided between stages I and II, 36% were stage III, and 30% were Stage IV. Among those with stage I, 42% had highly favorable lesions (stage IA T1N0M0, tumor invading lamina propria or submucosa). The tumor grade showed an inverse relationship to pathologic stage (Table 8). Well-differentiated tumors decreased from 46.1% (stage I), and 36.6% (stage II) to 29.2% (stage III) and 24.2% (stage IV).

The major histologic types were adenocarcinoma (84%), signet ring cell tumors (8.3%), mucinous cancers (2.8%), and diffuse (1.4%) or intestinal (1.3%) and other less frequent types (Tables 9 and 10). Lauren's classification was applied to only 1669 patients: 55% were designated as diffuse, 31% as intestinal, and 5% as mixed (Tables 9 and 10). Among the 949 adenocarcinomas, 47% were diffuse and 36% were intestinal. Of the 187 signet ring cell cancers, 87% were diffuse and 2% were intestinal.

Survival

The 5-year survival for the 1982 cohort was expressed as observed and specific for each pathologic stage reflecting deaths from all causes. The overall 5-year survival rate reflecting deaths from all causes was 14% among 9507 patients with histologically confirmed adenocarcinoma diagnosed in 1982 (Fig. 1). The overall survival rate after resection was 19%; the overall disease-specific survival at 5 years (reflecting only deaths from this cancer) was 26%. The overall survival rates according to stage were as follows: stage 1, 50%; stage II, 29%; stage III, 13%; and stage IV, 3% (Fig. 2). The 5-year survival rate was 59% for stage 1A (T1N0M0) and 44% for stage 1B (T2N0M0). The effect of margin involvement (completeness of tumor clearance), as determined pathologically, could be evaluated in 5496 patients with pathologic data available relative to involvement of the surgi-

Table 8. ASSOCIATION OF TUMOR GRADE WITH PATHOLOGIC STAGE AT DIAGNOSIS (1982 AND 1987 STUDIES COMBINED)

Pathologic Stage	1982	1987	% of Tumors With Grade		
			Well/Mod./Diff.	Poor/Undiff.	Unknown Grade
I	17.1%*	19.6%	46.1	37.9	16.0
II	16.9%	15.1%	36.6	50.5	12.8
III	35.5%	35.7%	29.2	59.1	11.7
IV	30.5%	29.6%	24.2	60.3	15.6
	6,742 patients	4,345 patients			

* The per cent unknown grade is included in calculations.

cal margin after partial or total gastrectomy. Among those with microscopically clear margins, the overall 5-year survival rate was 28%, while it was 8% in those with microscopically involved margins and 3.0% in those with grossly involved margins. The 5-year survival rate after complete resection of gross disease with clear margins was 32% for lower third, 38% for middle third, and 20% for upper third cases. The survival rate after complete resection for entire stomach involvement was 12%. In a subgroup reported as having all gross disease resected, including distal and proximal margins, the survival was 35% in those with microscopically clear margins and 13% in those with microscopically involved margins (Fig. 3).

The overall 5-year survival rate according to the most common histologic types was 12% to 14% (adenocarcinoma, signet ring, mucinous, and diffuse). Among the less common types, papillary and intestinal types had better 5-year survival rates (16% and 26%, respectively), whereas patients with undifferentiated cancers had a rate of 10% and those with adenosquamous cancer a rate of 4%. Survival rate correlated with degree of tumor differentiation (grade) and ranged from 11% in poorly differentiated cancers to 17% and 22% in patients with moderate- and well-differentiated cancers (Fig. 4). The 5-year survival rate according to Lauren's classification could be evaluated only in 900 patients who were thus classifiable and was 23% for the intestinal type, 18% for the mixed type, 14% for "other," and 10% for the diffuse lesions (Fig. 5). There was a survival difference between the intestinal and diffuse types ($p = 0.001$) (Fig. 5).

The overall survival rates according to stomach site are given in Figure 6. Overall survival rates were highest in patients with lower or mid gastric cancers (19% and 20%, respectively), but were only 10% for upper third lesions and less than 4% for lesions involving the entire stomach (Fig. 6).

Survival According to Gastric Site and Type of Surgery

Survival according to extent of tumor resected and the gastric site in patients treated in 1982 is shown in Figures 7 and 8. Survival curves were generated according to the type of gastrectomy performed, whether subtotal, total, or extended gastrectomy, within each anatomic site in patients treated in 1982.

Table 9. DISTRIBUTION OF PATIENTS BY HISTOLOGY (1982 AND 1987 STUDIES COMBINED)

Histology	No. of Patients
Adenoca	13,577 (84.3%)
Signet ring cell CA	1,333 (8.3%)
Mucinous adenoca	448 (2.8%)
Diffuse type adenoca	231 (1.4%)
Intestinal type adenoca	208 (1.3%)
Papillary adenoca	129 (0.8%)
Undifferentiated CA	124 (0.8%)
Adenosquamous CA	40 (0.2%)
Tubular adenoca	18 (0.1%)

A total of 16,108 patients (87.7%) had a histologic diagnosis.

Table 10. DISTRIBUTION OF PATIENTS BY HISTOLOGY—LAUREN'S CLASSIFICATION (1982 AND 1987 STUDIES COMBINED)

	1982	1987
Diffuse	538	376
Intestinal	253	272
Mixed	46	44
Other	86	54
Not recorded	10,341	6,355
Other response		

Examined in 1,679/18,365 = 9.1%.

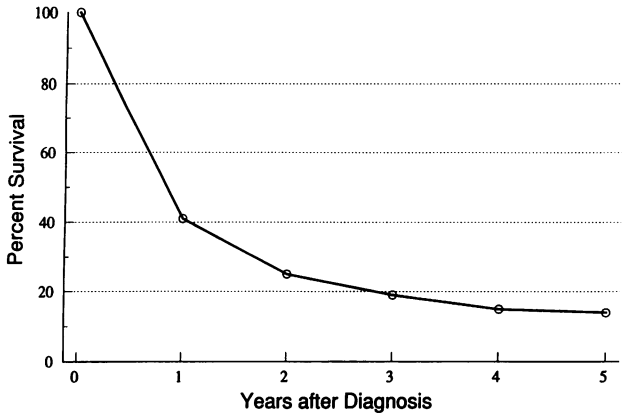

Figure 1. The overall survival rate reflecting mortality from all causes in patients with gastric carcinoma diagnosed in 1982 was 14%.

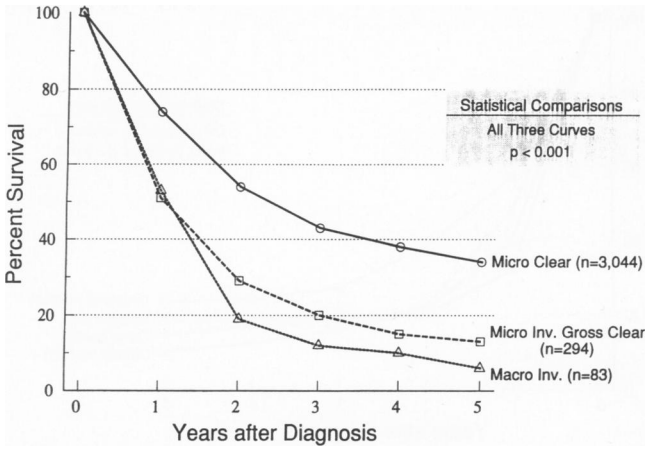

Figure 3. The overall 5-year survival rate according to completeness of resection was 34% in patients with all gross disease resected whose margins were microscopically clear, 13% in patients whose margins were microscopically involved, and 6% in patients whose margins were grossly involved (essentially palliative resection). The difference between "micro clear" and micro involved or macro involved was significant (p = 0.0001).

In patients with distal gastric cancer, the 5-year survival rate was 34% after total gastrectomy *versus* 26% after subtotal resection and 21% after extended resections (p = 0.01) (Fig. 7). In those with middle third gastric cancer, the survival rate was 38% after subtotal resection, 31% after total gastrectomy, and 25% if an extended resection was done (p = 0.06) (Fig. 8). In those with upper third cancers or in those with entire stomach involved, there were no differences according to type of resection (Figs. 7 and 8).

Effect of Blood Replacement

Survival was not altered according to blood replacement. There were no survival differences in groups receiving 1 or 2 units *versus* 3 to 4 units or greater then 4 units. In patients with stage I cancers only, there were survival differences in those receiving 1 to 2 *versus* more than 4 units (p = 0.0043).

Patterns of Recurrence

In patients treated in 1982 with clear margins at time of resection, 38.9% recurred, 48.7% had not recurred at the time of this report, and 12.5% were unknown. The distribution of type of recurrence differed somewhat according to primary site (Table 11). The first recurrence was local in 22%, regional in 19%, and distant in 59% of the overall group. The median time to recurrence was 10.5 months (local and regional patterns), and the median time to distant metastases was 11.5 months. Among

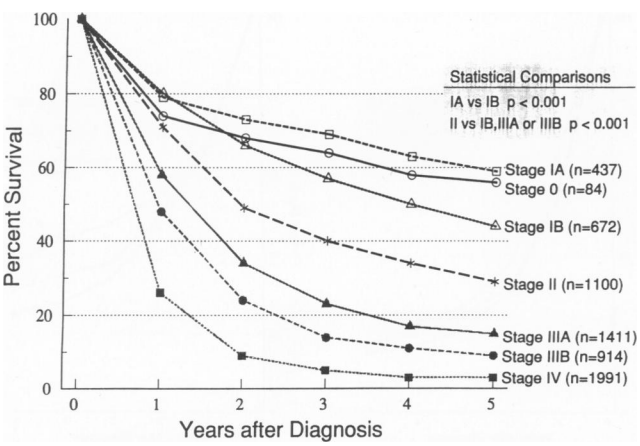

Figure 2. The overall 5-year survival rate according to pathologic stage for patients diagnosed in 1982 was 50% for stage I, 29% for stage II, 13% for stage III, and 3% for stage IV. The 5-year survival rate in the subgroups was 59% for stage IA, 44% for stage IB, 15% for stage IIIA, and 9% for stage IIIB.

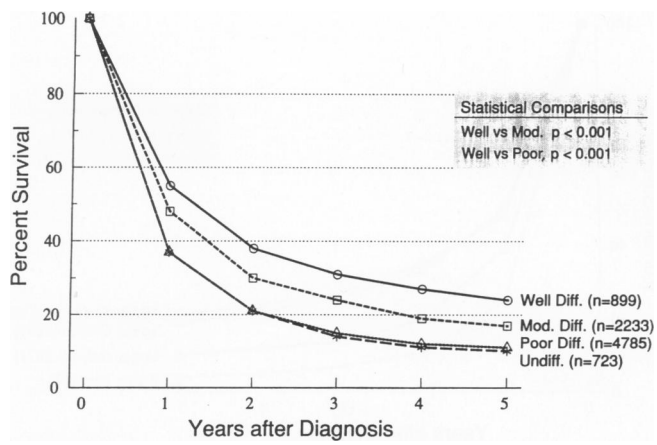

Figure 4. The survival rate according to tumor grade was 24% for well-differentiated, 17% for moderately differentiated, 11% for poorly differentiated, and 10% for undifferentiated cancers. The difference between well or moderately differentiated cancers *versus* poorly or undifferentiated cancers was significant (p < 0.0001).

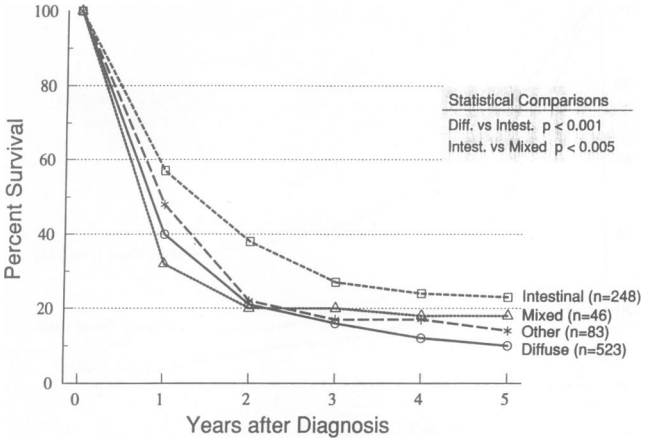

Figure 5. The survival rate according to Lauren's classification was 23% in patients with intestinal types, 10% in those with diffuse type, and 18% in those with mixed type. Diffuse *versus* intestinal, $p < 0.001$; mixed *versus* intestinal, $p = < 0.005$.

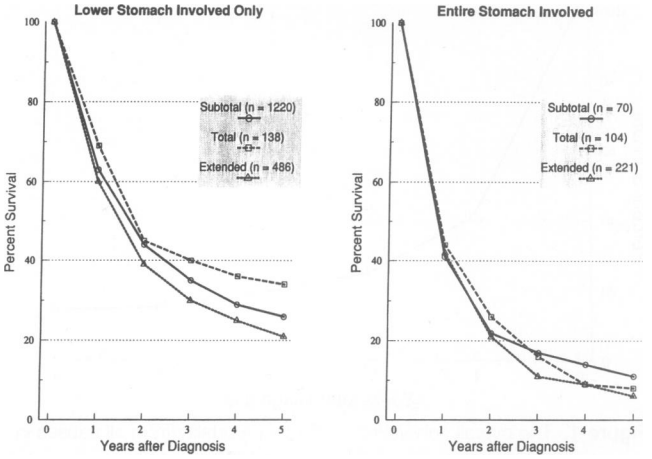

Figure 7. The survival rate according to extent of surgery for lower gastric cancer showed apparent improvement to 34% with total gastrectomy *versus* 26% for subtotal and 21% for extended resections ($p = 0.01$). Survival of patients with entire stomach involvement by cancer was not different according to type of resection.

420 patients with local recurrence, results of endoscopic examination were positive in 58% and negative in 8%; the examination was not performed in 24% or results were unknown in 24%. Among 96 patients with recurrence in whom a CEA test was done, CEA was elevated in half and normal in half. In patients with regional or distant disease, the CEA was positive in about 56% of the cases. The first recurrence was managed surgically in 27%, by chemotherapy in 32%, by radiation in 14%, and by chemotherapy and radiation in 9%. Surgery plus chemotherapy and/or radiation was given to 18% of the patients.

DISCUSSION

This American College of Surgeons patient care study has reviewed diagnostic, prognostic, and therapeutic factors of more than 18,000 patients with gastric cancer for whom data were collected at two time periods—1982 (long-term study) and 1987 (short-term study). An extensive data base was collected and analyzed about a disease that in the early part of this century was a major source of cancer death but that has decreased in incidence over the ensuing decades.[4]

That gastric cancer is a disease of aging is demonstrated by the fact that 47% of the cases in males and 59% of the cases in females occurred in those who were older than 60 years, and 48% of the males and 59% of the females were older than 70 years. In comparison to a previous North American study of 1241 patients diagnosed before 1961, the current series has a higher percentage

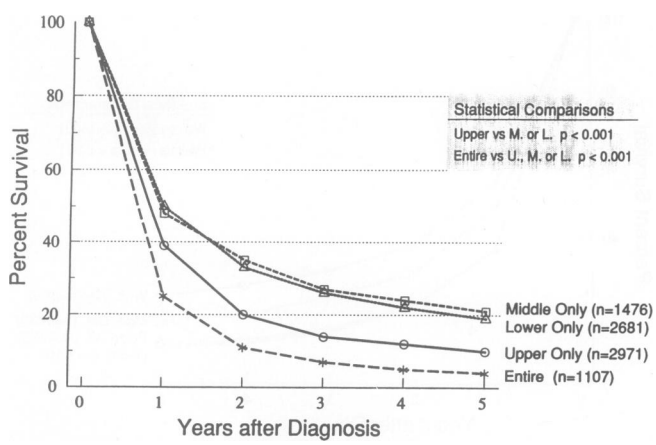

Figure 6. Survival according to stomach site involved. The survival rate was 19% to 21% for lower and middle gastric cancer, 10% for upper gastric cancer, and about 4% for total stomach involvement. Upper *versus* lower or middle gastric cancer, $p < 0.001$; all sites *versus* total stomach involvement, $p < 0.001$.

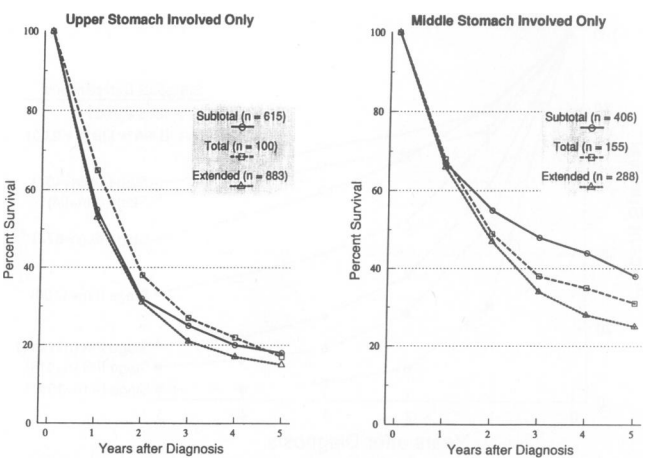

Figure 8. In patients with gastric cancer of the mid-stomach, the survival rate was 38% after subtotal resection, 31% after total gastrectomy, and 25% after extended resection ($p = 0.01$). In patients with upper stomach cancer, there was no difference according to extent of resection (survival rate approximately 15–18%).

of women (30% *vs.* 37%).[2] This may reflect the aging of America with women living longer, thereby allowing for a greater occurrence of gastric cancer. The frequency of symptoms appears to be lower than that noted in the earlier study,[2] again reflecting the possibility that patients are seen earlier by physicians.

Among the major findings that emerged from this study was the change in diagnostic methods during the two time periods. Use of gastroscopy increased and use of upper gastrointestinal barium study decreased. Despite increased use of endoscopy, there was no basic change in the stage of disease; two thirds of patients still presented with stage III and IV disease. This is in contrast to the rapid improvement in detecting gastric cancer at its early stage in Japan that correlated with mass screening with aggressive use of endoscopy.[7]

Regarding patient history, gastric ulcer was recorded in 26%, gastric polyps in 3.5%, and large bowel polyps in 3.0%. The relatively high frequency of bowel polyps raises the question of a possible relationship between the occurrence of large bowel polyps and gastric cancer. Previous studies of syndromes with large bowel polyps have not shown an obvious relation to development of gastric cancer.[5] The occurrence of gastric polyps in patients with polyposis syndrome has been recorded.

The high frequency of gastric ulcer in the recorded history of gastric cancer patients emphasizes the need for aggressive diagnostic and therapeutic approaches to this entity. Although the incidence of cancer in patients with gastric ulcer is about 10% in the Adkins-Sawyer report,[8] the high frequency in this study suggests that gastric ulcer was either incorrectly diagnosed or perhaps undertreated. Aggressive medical therapy for gastric ulcer over a defined time period with prompt surgical intervention for nonhealing ulcers has been advocated for years, but this policy may not be commonly followed.[9,10] A majority of patients presented with classic symptoms of gastric ulcer, which indicates the need to upgrade diagnostic efforts in these patients. The decreasing incidence of gastric cancer may have dulled awareness of the need to document healing of apparently benign gastric ulcers. Perhaps in high-risk categories patients should be aggressively screened. This might include patients with a long standing history of gastric ulcer or gastric polyp, known achlorhydria, previous peptic ulcer surgery (propensity for gastric stump cancer), family history of gastric cancer, or polyposis syndromes.[11–13]

Table 11. DISTRIBUTION OF TYPE OF FIRST RECURRENCE BY ANATOMIC LOCATION OF PRIMARY STOMACH TUMOR (1982 AND 1987 COMBINED)

	Anatomic Location			
Type of First Recurrence	Upper Only	Middle Only	Lower Only	Entire Stomach
Local	202 (26%)*	52 (18%)	113 (17%)	25 (22%)
Regional	131 (17%)	49 (18%)	149 (23%)	21 (18%)
Distant	432 (57%)	178 (64%)	389 (60%)	68 (60%)

* Column per cents add to 100.

The histology most commonly reported in this large series was adenocarcinoma (84.3%). The remaining histologic subtypes were too fragmented and uncommon to provide meaningful survival data. Lauren's classification was employed in only a small portion of the series and demonstrated an increased percentage of the diffuse type, which correspondedly had a worse survival than that of the other major (intestinal) type. The diffuse type, which is more common in the Western series, is thought to carry a worse prognosis than the intestinal type, which is the more common variant in the Japanese series. The prognostic significance of the Lauren's subtypes could not be analyzed in this series because of small numbers. Tumor grade also correlated with known prognostic factors. The well or moderately differentiated cancers were more common in the less extensive tumors (46.1% in stage I), whereas poor or undifferentiated tumors predominated in the more advanced disease (60.3% in stage IV).

Surgical results are similar to those of other reported Western surgical series.[14–18] Outcome is stage related. Patients with stage I and II disease had overall 5-year survival rates of 50% and 29%, respectively, after gastric resection, whereas the rates were 13% and 3% in those with stage III and IV disease, respectively. Patients with Stage I disease involving the middle third of the stomach in whom all disease was resected with clear margins did the best. The 5-year overall survival rate for this group was 61% (data not shown). The effect of the extent of surgical resection on survival is difficult to assess because of the heterogeneity of techniques by such a large group of surgeons. Only a small percentage had dissection similar to the Japanese R_2 dissection. Only 13.6% had a celiac node dissection, which is the minimal lymphadenectomy in the R_2 dissection. The pattern of first recurrence in patients having resection with curative intent (clear margins) was local-regional in 40% and distant in 60%. The high local regional failure has been commented on by others[19–21] and suggests the possible benefit of a more aggressive primary surgical resection (R_2 dissection) as well as the potential benefit of adjuvant radiation and/or chemotherapy for high-stage patients. In this study, however, adjuvant therapy was given to 665 (42%) of 1612 patients with clear margins after resection and produced no obvious survival difference compared to patients treated by surgery alone. This was not unsuspected

Table 12. COMPARISON OF GASTRIC CANCER RESULTS AS RECORDED BY THE AMERICAN COLLEGE OF SURGEONS (ACS) STUDY AND SELECTED JAPANESE HOSPITALS*

	Incidence		Resected Patient Survival (%)	
	Japan	ACS Study	Japan	ACS Study
No. of patients	15,589	18,365	12,535	10,237
Stage I	33.7	17.1	95.6	50.0
Stage II	14.5	16.9	70.1	29.0
Stage III	28.7	35.5	36.3	13.0
Stage IV	23.1	30.5	23.1	3.0
Overall survival	45.4%	14%	56.3%	19%

* Maruyama K. World J Surg 1987.
Collected from 56 Japanese hospitals nationwide (1967–73). Survival data corrected for age.

in view of the lack of effective chemotherapy agents for the disease.

Comparison with other large data bases such as those collected from a review of 56 Japanese hospitals shows large prognostic and staging differences (Table 12).[7] The Japanese data had a high frequency of stage I gastric cancer (34%) compared to the US series (17%), with fewer stage III and IV (52%) cancers than the US (66%). The overall survival rate of resected patients in the Japanese series was 56.5% (corrected for age) *versus* 19% in the ACS reviewed patients. Although there are problems in comparing these two retrospectively collected data bases, the large patient numbers perhaps permit some inferences.

Not only was stage more advanced in the US series, but the 5-year survival rate was also worse according to stage. This may partly reflect that the Japanese series had more complete resections of the primary tumor and dissection of lymph nodes and more careful pathologic staging. The Japanese patients were more likely to have an aggressive node dissection compared to patients in the US series, and were staged more adequately. In the US series, patients probably were deemed to have less disease than what truly existed (understaged). The surgical results are not only inferior to those recorded in the Japanese series, but are also worse then that recorded in some single institutional series in the US.[22,23] The ACS series more likely represents the true state of affairs overall in the US. Although mass screening as done in Japan would have the potential to upgrade survival by improving stage of detected cancers, this is not considered feasible because of the relatively low incidence of the disease in the US. Perhaps the staging can be improved by earlier referral for gastric surgery of patients with precursor lesions, *i.e.*, nonhealed gastric ulcer or gastric polyps. Special education of the surgeon in the requisites for adequate gastrectomy with node dissection coupled with effective adjuvant therapy[23] may increase the survival of patients with gastric cancer who are subjected to surgery.

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